air, which causes extreme cold and frost, such as is felt in Provence and Italy, which I have often experienced when I was at Genoa, when the wind blew over the land from the high mountains, making it as cold as it was in Holland. I have found by experience in all countries, during winter, that when the wind blows from the land the hardest frost makes. It is so in New Netherland also, for as soon as the wind is southwest, it is so warm that one may stand naked in the woods, and put on a shirt.

Again Penn's idea that clearing away the trees would improve the cloudiness or fogginess, while representative of his times, would not be generally accepted to-day as a safe method to follow. However, his observations show a keen appreciation of nature; and we are fortunate in having his letter preserved. It helps to forge one more link in the chain of evidence tending to prove that no permanent discernable change has been taking place in our climate.

One phenomenon of interest is not recorded in the extracts above. Penn makes no mention of the weather which we call "Indian summer." Two explanations for the omission occur to the writer: (1) A busy administrator might have failed to remark the season, experiencing it but once. Indian summer is often not well marked, and attracts attention rather by its repetition than by striking characteristics; Penn had been here but one year when he wrote his letter. (2) The fall of 1682 may not have presented a recognizable Indian summer at all, so that Penn really had not had an opportunity to observe it in America. However, Penn must have subsequently experienced many such Indian summers, and so acute an observer must have described this season somewhere in his writings. Can we find those descriptions, and does he there employ the term "Indian Summer"?[8]—C. A., jr.

ON WATERFALL ELECTRICITY AND ON THE SURFACE CONDITION OF LIQUIDS.[1]

By P. LENARD.

[*Reprinted from* Science Abstracts, Sec. A, Oct. 25, 1915, § 1416.]

The present communication forms part of a larger work on the problem of complex molecules. Under the name "waterfall electricity" the author includes the electrical phenomena accompanying waterfalls, splashing brooks, and rain, also water jets and drops as produced in the laboratory. In these cases the water becomes positively electrified while the negative charge passes into the air. Experiments have also been undertaken of bubbling air through water and of breaking water into spray, and the same phenomena found, so that these latter are classified under waterfall effects. For explaining these electrical accompaniments the liquid surfaces are assumed to be the seat of an electrified double layer, and the observed effects are due to the separation of this double layer whereby a charge of one sign remains in the liquid while the opposite one passes into the surrounding atmosphere. The varying forms of the effect are due to the different modes of separation. The present paper contains an investigation into the mechanism of the waterfall effect, and into the behavior of liquid surfaces considered as the seat of electrical and material stratification.

Section I deals with the superficial concentration of complex molecules and the forces operating on them. Here the idea of complex molecules receives detailed explanation, their distribution in the surface layer is considered, and the dimensions of the superficial forces comprehensively treated.

Section II deals with the waterfall effect as a consequence of the electrical nature of the molecular forces. First comes a detailed treatment of the electrified double layer at the surface; the surface tension in vacuo is found to be not much different from its value in air, while there is no frictional electricity developed between water and air. The rapid disappearance of liquid surface (e. g., by impact on a wetted surface, by water drops falling into water, or by coalescence of drops) is next considered, and the conclusion drawn that the separation between air and water is not the active agent in the production of the waterfall effect. Ordinary distribution of fluid is ineffective; spraying, on the other hand, brings about the effect, and in general the separation of very small liquid particles from the surface acts as a fundamental cause. The waterfall theory of thunderstorms is next exhaustively discussed. Important evidence that contact electricity between gas and liquid is not the origin of waterfall effects is afforded by the very small influence which the nature of the gas exerts, comparative experiments having been undertaken with hydrogen, methane, nitrogen, carbon monoxide, air, and oxygen.

Section III deals specially with the surface conditions of fluids. Every liquid surface has been found to consist of a number of strata which are both electrically and materially different from each other, and such stratification extends to a depth equal to the sphere of activity. From a knowledge of these strata may be gathered an insight into such surface phenomena as surface tension, waterfall effect, photoelectric activity, etc, also the influence of dissolved substances. Purely dielectric fluids, such as water, alcohol, benzol, are first considered, the surface constitution, the field strength of the double layer, and the waterfall effect being critically examined. Following this comes the behavior, from every standpoint, of dissociated nonvolatile electrolytes, i. e., dilute aqueous salt solutions, and a comparison is made by varying the anions and kathions. The nature of the carriers of the various electrical effects is next discussed. Partially dissociated nonvolatile electrolyte, e. g., concentrated salt solutions, then receive attention, followed by undissociated nonvolatile fluids—for instance, sugar solution. Solutions of volatile solutions, such as aqueous solutions of hydrochloric acid, ammonia, alcohol, and ether are then treated and finally the surface behavior of metallic mercury is considered.

Some of the general conclusions are as follows: A simple expression has been found for the surface concentration of solutions of nonvolatile substances and analogous fluid mixtures. An insight was afforded into the surface behavior of liquids containing molecules of different dimensions, by an investigation into the dependence between the molecular surface forces and molecular volumes. It has been shown in six different ways that the electrified double layer whose presence at liquid surfaces is shown by the waterfall effect, does not originate through contact electricity between gas and fluid, but that its seat is entirely within the fluid in such a way that the external molecular layer is negatively and the interior layer positively charged. The cause of this double layer lies in the electrical nature of the molecular forces, and in like manner can be regarded the phenomenon of contact electricity on dielectric bodies. The different forms of the waterfall effect, as also its presence under certain conditions and its absence in others, are explained from

[8] It is well-known that the Swedish pastor John Campanius kept weather records 40 years earlier than this letter, at the Swedish settlement in Delaware. A reference to his observations is given in this REVIEW, December, 1901, 29: 565: and a summary of his observations is printed in the Climatological Summary for the Maryland-Delaware Section, November and December, 1901. They have been presented by Nicholas Collin in Trans. Amer. Phil. Soc., Philadelphia, 1818, 1:340-352, in connection with later observations from other sources, and published in detail by Campanius' grandson in "Kort beskrifning om Nya Sverige," Stockholm, 1702, 4°.

[1] *See* Ann. d. Physik, July 8, 1915, 47 IV: 463-524.

the standpoint of disturbance experienced by the electrified double layer. The waterfall theory of thunderstorms now appears probable since the discrepancies hitherto attached to it have been removed by the preceding results. A large number of singularities accompanying the waterfall effect, together with the photoelectric activity and the surface tension of different fluids, can be traced to their surface conditions.—*H. H. Ho[dgson]*.

GAGE APERTURE AND WEIGHT OF CATCH.

By Prof. CHARLES N. HASKINS.

[Dated: Dartmouth College, Hanover, N. H., Nov. 20, 1915.]

In connection with the problem of determining snowfall or rainfall by weighing, I note the following simple relation which seems to be of interest in that it enables private observers to determine the precipitation in this way without the use of specially graduated balances. The relation is: If the diameter of the gage is 10.5 inches, the rainfall in hundredths of an inch is equal to twice the weight of the catch in ounces. This relation is true to within about 1 part in 2,500, which is of course of ample precision. The proof of this results from a simple calculation.

ATMOSPHERIC-ELECTRIC OBSERVATIONS ON THE THIRD CRUISE OF THE "CARNEGIE," 1914.[1]

By W. F. G. SWANN.

[*Reprinted from* Science Abstracts, Sec. A, Oct. 25, 1915, § 1317.]

The general course covered by the cruise was from Brooklyn (left June 8) to Hammerfest in northern Norway; from Hammerfest (July 25) northward to latitude 79° 52′ N. in the neighborhood of Spitsbergen, and then southwestward to Reykjavik in Iceland (Aug. 24), and so back to Brooklyn. The measurements discussed in the present report are those of potential gradient, conductivity, and the radio-active content of the air. Potential gradients were measured by the use of an ionium collector projecting from the stern of the ship connected to a Wulf bifilar electroscope. The standardization of this apparatus was carried out by means of simultaneous ship and shore observations on two occasions. The conductivity was measured by Gerdien's method, and a few observations were also taken of the ionic numbers. The radio-active content was measured by the stretched-wire method of Elster and Geitel with certain modifications devised by the author. There is some uncertainty as to what the measurements obtained by this method really mean, and a considerable amount of discussion is devoted to the point.

The mean potential gradient found on the voyage was 93 volts per meter. The measurements were made between 9 a. m. and noon, at which period of the day Simpson and Wright found in the South Atlantic a mean value of 80 volts per meter; so that, considering the difficulties in the way of obtaining absolute readings, there is a fair agreement between the two results. The mean conductivity was 2.52×10^{-4} electrostatic unit. This is rather greater than the average value found on land. Passing out to sea from the American shore, the conductivity appears first to fall somewhat below the normal land value, and then increases again as the vessel gets out into the open sea. This distribution was observed both on leaving and returning to the shore. The local decrease near the shore is found to be due to a low value of the specific velocity of the ions in the same region. The electrical results have been grouped in various ways with the different meteorological elements, but no marked relationships are found. In discussing the radio-active content, the mean value expressed in Elster-and-Geitel units is found to be 23, corresponding to about 12×10^{-12} curie of radium emanation per cubic meter. This amount is much smaller than would be necessary to account for the conductivity of the air. A similar result has been found by most observers. In the latter portion of the paper an application of the theory of radio-active disintegration is made to the decay curves obtained in the Elster-and-Geitel method, and it is found that while some of the curves can be accounted for by the presence of radium emanation alone in the atmosphere, others appear to require the presence of some more slowly decaying products than those of radium emanation.—*J. S. Di[nes]*.

[1] *See* Terrest. magn., March 1915, 20: 13–48.

FOGGY DAYS IN MANCHESTER, ENGLAND.[1]

By W. C. JENKINS.

[*Reprinted from* Science Abstracts, Sec. A, Oct. 25, 1915, § 1377.]

An inquiry as to whether the number of foggy days in Manchester [England], has increased or decreased in the past 10 years. A distinction is drawn between "fog days" or days of surface fog, and "gloom days" or days on which there was fog at a little distance above the surface but not actually on the ground. The figures for the 10 years are arranged in various ways, and it is found that taking the year as a whole the number of foggy and gloomy days combined has increased 30% between the beginning and ending of the period. The most marked part of this increase is in the number of days of gloom.—*J. S. Di[nes]*.

PHYSICAL CONDITIONS OF THE ACCUMULATION OF THE SUN'S HEAT IN THE SALT SEAS.[2]

By M. RÓZSA.

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The investigation of the accumulation of the sun's heat in some salt seas was first undertaken by Kalecsinzky, and the problem in general solved. In the present paper a report is given of the special physical conditions of the warming process, and some experimental researches in connection with this. It is found that a considerable accumulation of the sun's heat can only occur in those salt seas in which the upper layers increase in concentration in consequence of a more permanent diffusion process.—*A. E. G[arrett]*.

ABSORPTION OF ULTRA-VIOLET AND INFRA-RED RADIATIONS BY ARABLE SOIL.[3]

By J. F. TRISTAN and G. MICHAUD.

[*Reprinted from* Science Abstracts, Sec. A, Aug. 30, 1915, § 982.]

Photographs were taken in ultra-violet light through a quartz lens, silvered after Liebig, which is transparent to light of from 3100 to 3300 Å units. For the photo-

[1] *See* Mem. Manchester lit. and phil. soc., Apr. 30, 1915, No. 5, 59: 1–4.
[2] Physik. Zeits., Mar. 15, 1915, 16: 109–111.
[3] *See* Archives des sciences, March, 1915, p 270–273.